TRIP REPORT - CRAIOVA, ROMANIA
WATER SAVINGS AND EFFICIENCY OPTIONS
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INTRODUCTION

The International City/County Management Association (ICMA) is under contract with the United States Agency for International Development (USAID) to provide assistance to local governments in Eastern Europe. Under this contract ICMA performed a preliminary evaluation of water efficiency/water savings and public education options for the City of Craiova, Romania. At the Request of the Mayor, a team of technical advisors including Denise Ruzicka, Water Conservation Coordinator for the State of Connecticut and Paul Hendricks, of Environmental Utilities Services, Phoenix, Arizona; evaluated the current potable water supply management operations for efficiency and presented public education/water savings program options for consideration. The technical advisors were asked to evaluate the current operation of the potable water supply delivery and management and determine possibilities for increased water efficiency and water savings. The goal was to develop an initial public education program design and to evaluate other water conservation and water saving options.

The recommendations in this report are based upon the information presented to the project team in addition to personal observations made during the weeks of June 27, 1994 and July 5, 1994. The project team toured the water facilities of the City of Craiova including sources, treatment facilities and major transmission lines.

Interviews and meetings were held with the Mayor, Director and Assistant Director of the Water Regia, City Council, University teachers, Judet educators, ecological groups, non-governmental organizations, youth group organizers, and representatives of homeowners/apartment associations.

CULTURAL CONTEXT

When discussing water conservation in Romania, it is important to understand the difference between how American's view the term "water conservation" and individual water use versus the Romanian context. A definition definition of water conservation is methods and procedures designed to promote efficient use of water and eliminate waste of water. This typically includes both demand side and supply side management components.

The term "water conservation" in Romaina was found to connote water use restrictions or rationing. The term also envokes to Romanians a broader definition of water resource preservation and conservation from an environmental or ecological perspective. Therefore, during this trip we utilized an alternative term of "water saving" when referring to traditional American water conservation programs. It is strongly recommended that any subsequent technical advisors deployed to Romania be advised to utilize the prefered term "water saving" or "water efficiency" in order to avoid confusion . The term water saving is utilized throughout this report.

The concept of supply management is not traditionally viewed by Regia personnel as being part of a water saving program, yet they acknowledge the need for metering, and improved wellfield performance. The concepts of leakage, theft, or loss of water were generally minimized. It is recommended is that reduction of unaccounted-for water be a major focus of a water savings program for Craoiva. Improvements to reduce unaccounted-for and lost water could significantly increase the amount of water available to the City on a continuous basis.

PUBLIC EDUCATION

The primary purpose of this trip to Craiova was to initiate a water saving/public information program. A basic building block of any water saving program is a continuing program of public education. Initiating a public education/water saving program was the major achievement of this trip to Craiova.

Meetings were held with the Mayor and City Council. Mayor Dan Nicloae is a strong advocate of the need for public education on water saving, especially for children. This is a special area of focus for the Mayor. A preliminary meeting was held early in the trip with community representatives in which general information on the types and examples of public information methods and techniques was presented. Methods discussed were: press releases, bill stuffers, bill messages, leaflets, in-school programs, posters, special activities, etc. A State of California Department of Water Resources guidebook, entitled Designing a Public Information Program for Water Conservation, was used as the basis of discussion. Copies of his document should be obtained and made available to Regia and City Hall staff during a follow-up trip.

Examples of various types of water saving information were handed out, including a water conservation guidebook prepared by the State of Connecticut, a full package of American Water Works Association (AWWA) bill stuffers, stickers, posters, sample retrofit kits, leaflets, coloring books, teacher's manuals, and newsletters, stuffers and leaflets, stickers, teacher's manuals, water booklets, etc. As a result of this initial meeting, follow-up meetings were scheduled with various focus groups, including the Regia, the press, school teachers, ecological and non-governmental groups, and apartment associations.

At all meetings, participants were very receptive to initiating a water saving/education program. At the subgroup meetings more specific examples were provided and discussed.

The idea that water saving programs can be inexpensive and easy to adopt was promoted. Often the misconception was that water conservation meant rationing or undue hardship or sacrifice. Water saving, as opposed to water conservation (see cultural discussion), means user habit and hardware changes that result in water use reduction without compromising current uses or standards of living. The phase suggested by our interpretor - "Folositi apa cu masura" or "Use water wisely" - was very well received. The literal Romanian translation of "Folositi apa cu masura" is "To use water with measure", ie. don't waste water.

I emphasized the advantages of the different groups working together to develop generic water savings materials that could be reproduced under different flagship headings, or in different formats, so that all groups could benefit and not reduplicate efforts. They were receptive, however, this coordinated approach is stronger when developmental costs exceed printing costs like in the US. In Romania, printing costs are a limiting factor to distributing public informational documents. That is why posters are a favored and prevalent mode of public communication. While xeroxing and reproduction costs are similiar to the US, labor costs are significantly lower. This reverses the cost relationship.

At all meetings, and universally among participants, all groups expressed problems with obtaining funding to reproduce materials. (This statement includes the view of the Regia staff.) The non-governmental organizations and ecological groups are very interested in finding out how American groups operate, receive funding, etc. They were also interested in obtaining information on types of activities and programs offered by American environmental groups and examples of water savings information. The relationship between water saving and water resource preservation was also discussed.

IN-SCHOOL EDUCATION PROGRAMS

ICMA technical advisors met with local educators to discuss water saving education for children. Samples of guidebooks and teachers manuals were distributed. The meeting arranged by City Hall included representatives of local boy and girls clubs, soroptimist clubs, judet cirriculum specialists, nursury school coordinators, and teachers from the local technical schools and the university. There is a great interest on the behalf of teachers and educators to develop a water saving and environmental cirriculum for children. They have teachers willing to introduce programs to the local schools and serve as school coordinators. The Mayor is very supportive of water saving education for children.

After a brief discussion of educational approaches employed in successful American water saving programs, a lengthy discussion ensued regarding the lack of materials, lack of funding and scarity of books on water education for children. Educators represent a special group, vital to successfully implementing a water saving program. They expressed great interest in implement such a program.

In order to meet the special needs of educators, it is suggested that a teacher experienced in water saving education conduct a seminar on teaching techniques, cirriculum development, and water conservation and savings instruction. This teacher training workshop could train "masters" how to best use water saving education materials. The master teachers are usually science or environmental teachers who train can train classroom teachers within their school systems. By providing expertise and

materials to a group of team leaders from each school, a broad segment of the educational system could be reached.

The majority of American "in-school" water saving education programs stress the importance of reaching children in order to form a water conscious generation of consumers and to develop individual responsibilities for resource conservation. Water awareness programs as a rule are developed as continuous efforts, not just one-time informational campaigns. Most of these programs are designed to be incorporated into the existing curricula of the school system through an interdisciplinary approach. There is an abundance of water saving curriculm materials available from American water utilities and professional organizations such as AWWA. Generally, cirriculum has been separately developed for different age groups: 6 to 10, 10 to 12, and 12 to 14 years old.

Due to the Mayor's enthusiam it is recommend that the teachers workshop focus on ages 6 to 10. Teachers guidebooks which include lesson plans, information, experiments, and cirriculum should be obtained, along with a gross of the associated student workbooks. This proposed seminar would be a high impact, low cost work element for ICMA technical advisors.

During a follow-up visit additional activities booklets and coloring books could be translated and reporduced for use by pre-schools.

REGIA PUBLIC INFORMATION OPPORTUNITIES

ICMA technical advisors met with Regia staff to discuss Regia activities and possible public information problem ideas. I met with: Mr.Popescu, Technical Director; Ms.Popa, Accounting Director; and Chiefs from the Technical Services Department, Water Department, Sewerage Department, and Economic Department.

The staff of the Regia was receptive to the idea of including a water saving message on the printed water bills. Due to the fact that the water bills are already computer generated, this method of communicating with the public will be put into practice starting with the next billing cycle (quarterly billing for residential customers). The list of "water saving tips" which were translated into Romanian was given to Mr. Popescu and suggested for use as possible bill messages. Ms. Marianna Popa, Programming/Accounting Director, was designated to develop the computer programming necessary to generate the water saving bill messages.

The Regia should consider developing an employee newsletter in order to keep employees abreast of water saving efforts, communications with the public, and infrastructure improvements. Employees are important ambassadors to the community at large. There are approximately 1600 employees of the local Regia. No commitment was received. Meeting attendees expressed some hestitation to communicate with employees vis staff meetings, since before the revolution employee meeting were frequent, mandatory, and not considered productive.

Various bill stuffers, handouts and tri-fold informational leaflets on water saving were handouted out.

The Regia staff also expressed concern about the inability to pay for reproduction of public informational materials. The Regia was formerly subsidized by the central government. Since the revolution these subsidies are changing and the Regia is finding it self unable to meet operating costs with current revenues. The anticipated metering program and EBRD requirements to raise rates should somewhat ameliorate this situation. Mr. Popescu indicated that bill stuffers or leaflets are very expensive to produce and that the cost of developing and printing materials exceeds the cost to produce the water. He did express a willingness to work on developing bill stuffers or water saving leaflets during the next visit by ICMA technical advisors, if printing was made available.

The Director of the Water Regia, Mr. Nicolaescu, periodically meets with radio and newspaper media to discuss activities of the Water Regia and status of the EBRD loan. We discussed techniques for dealing with the press, and encouraged him to be proactive suggesting press releases. Ms. Rodica Dudua at City Hall generally handled this function but didn't know technically how to write a press release. It is recommended that ICMA technical advisors have a basic format and some examples of "how to write a press release" translated and made available to City Hall and Regia staff during a follow-up trip.

Highlights and Results of the July 1994 trip included:

- A list of practical water saving tips was translated, revised for the Romainan audience and reproduced in a poster format. Three thousand (3,000) copies of this poster containing practical advice for saving water was developed and reproduced. A copy is attached as Appendix A (Romanian version). The English translation of this poster and a list of water saving tips is attached as Appendix B. The tips selected are mostly no cost, behavioral items that can be immediately instituted by the typical homeowner. The title was specific to Craiova. The Mayor and Chief of Staff suggested the heading "Do you want water 24 hours a day, if so follow these practical tips for saving water." The text for this document was produced on a computer disk which could be shared with other Romanian cities.

- Representatives of apartment associations, coordinated by Mr. Bordu, a City Councilman and apartment association representative, agreed to distribute and post 2,000 copies of the poster throughout the city in the lobby of each block of flats. This was thought to reach the broadest extent of persons in Craiova possible. Bulk mailing concepts have not reached Romania yet. The cost of mailing an item is approximately 15 to 20 cents (equivalent US dollars). Therefore, direct solicitations are cheaper given the current wage rates of approximately $1 a day.

- The remaining 1,000 poster copies are being made available to school groups, the Regia, and non-governmental organizations. Ms. Rodica Dudau of the City Hall agreed to coordinate distribution of posters to these groups. The importance of determining the impact of these initial water saving ideas and gauging public receptiveness was stressed. Feed back from apartment associations should be requested on a follow-up trip and the tips deleted or modifed as necessary.

- An additional 2,800 misprinted posters with the same water saving tips were delivered to City Hall for general distribution. These were mistitled "Practical Advice for Parents" instead of "Do

you want water 24 hours a day, if so follow these practical tips for saving water." Due to the printer's error these were a free bonus. Although the water saving tips in the body of the poster remain the same, the utility of these posters is unclear.

- Five hundred (500) copies of a children's coloring and activities book targetted to 4 to 6 year olds was developed, translated, and printed. This coloring book was based upon a similar American coloring book which was translated, then revised for Romanian audience, and reproduced. The apartment associations, nursery school directors, chief of Judet cirriculum board and university teachers expressed interest in utilizing this document. This pilot publication was developed to serve as a prototype of water savings materials and to provide an initial working document that could be subsequently refined based upon feedback from the initial users. Only a limited number of copies was provided. Ms. Rodica Dudau of the Mayor's office agreed to coordinate distribution among interested users.

  The coloring book was loosely based upon a Scripts Coloring Book, these are available for various age groups. The most basic one, geared to 4 to 6 year olds, was focused on due to the Mayor's special interest in educating young children. It is believed to be in the public domain given that it was developed using EPA and public funds. Many utilities, state organizations and federal agencies in the US utilize these materials Copyright would have to be investigated if it were to be mass produced. Given that the Romain copyright laws are quite different this is not anticipated to be an issue. The possibility exists to create original computer artwork for use in similiar coloring or children's activities books. Problems are obtaining local funding or computer access.

  On subsequent follow-up trips additional examples and copies of material geared to different age groups should be provided to give the groups a better idea of possible educational approaches. *Estimated cost: $200.*

- The Ecological Organizations agreed to support the concept of water savings education and promote water savings ideas to its members. The ecological groups and non-governmental organizations decided that it was important to continue to meet to discuss potential on-going efforts to promote water saving. They proposed forming an advisory group to advise the City Council on water saving measures. Mr. Codres Teclu, ADD title-position, will coordinate the activities of the ecological groups. The ecological organizations were instrumental in gaining the participation of apartment association representatives.

- The staff of the Regia was receptive to the idea of including a water saving message on the printed water bills. Due to the fact that the water bills are already computer generated, this method of communicating with the public will be put into practice starting with the next billing cycle (quarterly billing for residential customers). A list of water saving tips was translated and suggested as possible bill messages. Ms. Marianna Popa, Programming/ Accounting Director, was designated to develop the computer programming necessary to generate the water saving bill messages. It is recommended that the Regia utilize a different water saving message each quarterly billing period in order to offer variety and maintain interest.

- Interviews were given to two local radio stations (taped) and the local Craiova newspaper on the importance of water savings and the activities of ICMA technical advisors. The local Craiova newspaper editor promised a full front page article and agreed to print the poster containing water saving tips. He also agreed to periodically report on the progress of the water saving/education program.

- A short summary report was prepared, translated and transmitted to the Mayor's office. See Appendix ___ for the English language version of this report.

The following recommendations are made based upon the information gathered by the project team:

- The term "water saving" should be utilized when discussing the need for increased water efficiency. The term "water conservation" has negative connotations and can be misleading and therefore should be avoided. (See discussion on cultural context.)

- The City Council should be asked to adopt a goal and slogan for promoting water savings. It is recommended that the goal be "24 hours a day water" and the slogan be "Folositi apa cu masura!" or "use water with measure". This Romanian phase is the American equivalent of "Use Water Wisely."

- Madame Mariana Popa at the Regia was designated to develop the computer programming necesssary to generate the water saving bill messages. They committed to attempting to institute this change with the next quarterly billing cycle. It is recommended that the Regia utilize a different water saving message each quarterly billing period in order to offer variety and maintain interest.

- In addition, it is suggested that the bill message method, once in place, be utilized to communicate other information to consumers. For instance, once customer meters are in place, customers could be notified of water use changes by flagging all water uses above or below the normal range for the user or user type.

- The Regia should consider developing an employee newsletter in order to keep employees abreast of water saving efforts, communications with the public, and infrastructure improvements. Employees are important ambassadors to the community at large.

- The Regia and City Council should form a citizen's advisory group to work with the Regia in developing water saving programs and assisting in distributing the messages and previewing items to be published for user acceptability and user friendliness. This topic should be more strongly encouraged and discussed during follow-up trips to Craiova.

- The Mayor should request additional technical assistance in order to work with the Regia to develop water saving leaflets, "bill stuffers," or handouts. A follow-up trip could concentrate on translating and formating a variety of single page triple fold type of leaflets with general water system and water saving information.

- The Director of the Water Regia, Mr. Nicolaescu, should continue to periodically meet with radio and newspaper media to discuss activities of the Water Regia and status of the EBRD loan. Generally, information could be provided and discussed in a follow-up trip concerning dealing with the press and "how to write a press release."

- The Mayor and City Council should request additional technical assistance in order to provide a teacher's training workshop on water education cirriculum and teaching techniques. I recommend that ICMA set up a one week seminar and send a teacher experienced in water saving education.

  Estimate: Must send over sample cirriculum, teachers lesson plans, and work books in order to be effective. Cost of materials- 200 teachers books and 400 children's work books - minmum $15 each.

- Both the Regia and City Hall should designate a person to be responsible for coordinating and continuing water saving/education program activities with the various community groups. The Regia should designate a customer ombudsman to investigate complaints and assist in facilitating solutions. Discuss on follow-up trip

- A representative of an American environmental group should be sent to meet with the Romanian ecological groups and non-governmental organizations for the purposes of discussing organizational activities and methods and means of promoting water saving within the City of Craiova. Recommend sending a representative of an American river/watershed protection group, that has been a strong advocate, initiator and supporter of water saving programs.

- It is recommended that ICMA follow-up on initial trip efforts and provide on-going technical assistance in water saving/education. Follow-up is essential to ensure implementation of the water saving plan.

OTHER DEMAND AND SUPPLY MANAGEMENT OPTIONS

SUPPLY MANAGEMENT

Supply Managment is conservation measures which improve efficiency of and eliminate waste in the production and distribution of water within a system. Supply Management practices typically include activities that the water utlity can perform to improve system efficiency and reduce lost and wasted water.

A. Water System Evaluation and System Audits

The purpose of a system audit is to determine the amount, location and causes of unaccounted-for water use. Unaccounted-for water use is estimated by this technical advisor at 35 - 45% or more. A detailed audit requires customer metering information. Even in the absence of such information, an annual evaluation that is less rigorous is still recommended in order to quantify

water supply and production and preliminarily identify unmetered uses.

Another purpose of a water audit is to divide unaccounted-for water into two categories, authorized and unauthorized. Authorized uses include fire fighting, main and sewer flushing, street cleaning, and public unmetered uses including parks, and schools. By identifying these uses preliminary leakage rates can be estimated and a strategy to reduce authorized uses can be developed. For instance, open valves were noted in Romanescu Park, a large public park, garden, and zoo. More efficient spray hose adaptors could be installed as a demonstration program. In addition, use of on-site springs and ponds could be intensified.

A water audit and evaluation will help the water utility save water and protect revenue. After the Regia knows more about its unaccounted-for water, it will be in a position to determine what corrective steps to take. These include leak detection programs, calibration and replacement of meters, metering of previously unmetered facilities, and other changes to improve the operation of the system and save water.

Computing the cost-effectiveness of leak detection programs is incidential and almost unecessary given the excess amount of lost and unaccounted-for water currently being experienced. Residences in Craoiva are generally unmetered, although large industrial users are metered.

Prior to full metering, an audit can be performed utilizing a pitometric survey or night rate survey. This approach looks for above normal water usage by comparison of daytime flow rates with night time usage. This approach requires 24 hour water availability. A water audit equation can also be utiltized to give a gross estimate of leakage based upon generic estimates of residential per capita water usage. Master metering of sources is an essential requirement.

I was unable to discuss the concept of water system evaluations with Regia staff this trip, due to time limitations and absence of Mr. Nicolaescu, the Director of the Water Regia. He was in Bucureste for a course. Much system data is very "soft." Water system physical charactersitics and operational data is often estimated or assumed. There is a need to develop tracking procedures to capture "hard" data - data that is measurable and recorded. Further technical assistance to evaluate system record keeping and establish an annual system audit mechanism is recommended. The need to accurately determine unaccounted-for water quantities and reduce the same is a high priority item for the City to pursue.

RECOMMENDATIONS:

- Initiate discussions with Regia staff regarding current data gathering efforts and the extent to which production is monitored and other system characteristics and statistics are available, including mapping. This could be the focus of a subsequent trip.

- Based upon the above investigation:

1. Work with the Regis Staff to the extent necessary to develop additional tracking forms and mechanisms to account for amounts, locations and causes of unaccounted-for water.

2. Develop or enhance current annual water system evaluation process. Typical evaluation forms are available from AWWA in a computer disk format and could be modified to reflect local conditions and European units of measure.

3. Evaluate the need for the Regia to update water distribution maps including mains, hydrants, valves, blowoffs, and services.

4. Work with Regia staff to: identify current unmetered public uses, establish a strategy to develop alternative sources where appropriate, and to meter public uses.

- The City Council should require the Regia to perform an annual water system evaluation and to report production and usage by users category and amounts of unaccounted-for water for review (the term audit is not used since this infers the existence of customer metering.)

- Recommend that the Regia initiate a leak detection and repair program. Initial emphasis should be on transmission lines from Isvarna and Giroc.

- Recommend that the Regia immediately install master meters at all sources and major facilities.

B. Meter Management

1. SOURCE AND PRODUCTION MASTER METERING - *Highest Priority*

The major sources of high quality ground water for the City of Craiova are Isvarna and Giroc wells. Neither of these sources are metered as to the actual water quantity entering the transmission pipelines or entering the distribution system within the City boundaries. Therefore, yield and production values (current) are not firm. And the loss of water along these large diameter, long pipelines is not accurately known with any precision. A program to measure or meter all sources of water and other major Regia facilities should be of the highest priority of any metering or water savings programs.

The Regia Director expressed concern over the inability to meter larger type diameter 100mm pipelines that are not fully pressurized. The siphon groundwater collection systems at Bresta, Giroc and Isvarna enter the transmission pipelines as a semi-open channel flow. However, at the terminal well house at Giroc a trapezoidal weir was present within the chamber. It could be calibrated and a staff gauge flow curve developed. In this way, based upon daily measurements, flow variability could be determined. Regia staff feel that the flow never varies, although conceptually this conjecture is doubtful. Over the longer term a sonic flow measuring device could be installed to transmit data directly to the central Regia offices

in Craiova.

Flow recording and daily measurements should be obtained at the Isvarna, Giroc and Bresta wells, and at the treatment plants and pump stations prior to entering the distribution system.

RECOMMENDATIONS:

- The Regia should institute a program to achieve 100% master metering of all sources of water and major facilities. The first priority should be to establish measuring of all water entering at the sources. It is recommended that this be performed over the next year. Technical advisors could work with Regia staff to develop weir measurements and reporting forms.

- Information on transducers, pharshall flume and weir measuring devices and techniques should be provided and explained to Regia staff.

- Provide technical assistance to calculate stage/flow curves, install flow measuring devices, and establish recording and data collection methods.

2. CONSUMER METERING

A prime condition of the EBRD loan is that Craiova establish a metering program. At all meetings held with various interest groups (the Regia staff, City Council, Mayor, ecological groups and other non-governmental organizations, university and teachers, and representatives of homeowners associations) almost unanimous support was expressed for the need to meter and base customer bills on actual usage. This was viewed as both necessary and equitable.

As a rule metering is not considered in and of itself a water saving measure. Metering of both production and consumption is highly desirable in conducting water audits to determine the amount and nature of unaccounted-for water. Similarly metering is extremely useful in pinpointing areas of concern in leak detection and repair programs. Pricing methods aimed at reducing water demand are largely dependent upon metering of water use.

Metering has been credited with other use-related benefits. Installing meters may make people more aware of their water use and encourage some water saving regardless of price. Metering enables more equitable pricing and provides information to identify high use consumers and areas of increasing water use within a system. Water use metering is also desirable in projecting needs and assessing a system's capacity to meet those needs.

Consumer metering was not discussed with Regia staff on this trip. Metering issues that the Regia will likely need to address include: master metering and sub-metering of apartment

flats, type of meters (direct read or remote), meter sizing, and multiple meters for large users. As part of any metering program, an ongoing program of meter calibration, repair and replacement need to be instituted. Over time almost all meters will under register, thereby resulting in increased unaccounted-for water amounts and reduced revenues. Typical meter maintenance program information can be provided upon request.

A general recommendation is to install taps for in-line meter testing in all large industrial services. A metering program should begin with all commercial and industrial customers by replacing or repair existing meters.

RECOMMENDATIONS:

- It is recommended that a team return to Craiova to work with Regia staff and develop program design and criteria for a comprehensive customer metering program. A general recommendation is to install taps for in-line meter testing in all large industrial services. A metering program should begin with all commercial and industrial customers by replacing or repair existing meters.

C. Leak Detection and Repair

A leak detection and repair program should be developed as an on-going practice and integral part of any long-term water saving program. A comprehensive leak detection program is a condition of the EBRD loan. Design of such a program could be the focus of subsequent technical input from ICMA contractors. General information on leak detection equipment was given to Mr. Nicolaescu, Water Regia Director.

Residential water usage, as estimated by Regia staff, is _____liters per day (gpcd), this appears to be very similiar to typical American water usage of _____ (--- gpcd). However, this water usage in Craoiva is actually excessive when consideration is given to the fact that water is not available on a twenty four (24) hour basis to all sections of the City and that water using appliances such as washing machines and dish washers are not common household devices. These usage rates probably include system leakage (lost and unaccounted-for water). Therefore, one can deduce from these figures that leakage is excessive and a comprehensive program to reduce leakage and unaccounted-for water will significantly improve water availability and reduce operating costs.

Water leaked through a distribution system provides no compensating revenue. Repair of leaks recovers the cost of obtaining, treating and pumping wasted water without reducing revenues. Maintenance carried out due to leak detection and repair programs can also avert major problems and property damage. Through the use of leak detection devices utility managers can better evaluate the severity of leaks and concentrate their efforts on those which are the most significant, savings the expense of excavating in the wrong area.

Leak detection is somewhat of an art. Technical training is necessary in order to properly pinpoint leaks and estimate leak severity. It is recommended that a seminar be prepared and presented to Regia staff on water audit procedures and leak detection methods. Hands-on field practice and demonstrations are suggested in order for the training to be effective. Once developed and demonstrated in Craoiva, such a training program can be transferred and shared with other Romanian communities.

RECOMMENDATIONS:

- Provide technical seminar and field training in the use of sonic leak detection methods. Recommend purchasing an a aqua scope (sonic leak detector) equipment to provide to Regia staff and hiring consultant to provide one week class room seminar followed by one week of field training in use of equipment.
  Estimate: For example cost by Heath Consultants is $10,000 for seminar plus expenses. Cost of an Aqua Scope is $2,600 to $3,000.

- A detailed leak detection program should be designed, including training of Regia staff, development of survey procedures and record keeping forms, prioritization of repair of leaks based upon severity, and quantification of leakage reduction. This is a major undertaking necessitating an on-going local presence. Training and technical advice could be an appropriate first step for ICMA's continuing involvment in this critical area.

If requested, further information on designing detailed comprehensive systemwide sonic leak detection programs can be provided.

D. Process Water at Treatment Plants

Process water at treatment plants is the water lost (not recycled) after filter washing or sedimentation basin drainage at raw water treatment plants. An estimate of the quantity of process water utilized at the Bresta Pump Station and Isalnita Treatment Plant should be made by contacting plant operations staff and checking records.

Given the lack of defined plant operations, the first priority for improving treatment plant operations and increasing utility (Regia) water use efficiency is to translate and present to the Regia staff a standard treatment plant operations manual. No current operation manuals exist and a seminar of operational techniques based upon a standard manual is advisable. As part of the seminar on plant operations and chemical handling, information on record keeping should be presented. Technical advisors should work with Regia staff to develop reporting form and computerized tracking systems.

The benefits of translating and presenting a general operations manual include: improved treatment plant operations, improved finished water quality, safer chemical handling, reduction of process water use, and reduced energy requirements. These improvements result in additional benefits to the City including: increased public health and disease suppression due to improved

water quality, improved public relations, reduction of customer complaints, and a safer work environment for plant employees.

Estimated water savings from improved plant operations is a reduction in process water use by 50%.

RECOMMENDATIONS:

- Translate and provide a basic manual for operation and maintenance of the treatment plants and pump stations. Given the health and safety implications, this item should be a priority task completed within the next six months.

- Encourage Regia to aggressively work to remove birds and nests from facilities These were observed at the Isvarna Station, Bresta Pump Station and Treatment, and the Jiu Treatment Plant. Birds are disease carriers, particularly of viruses and cysts. Eliminating the birds will result in improved water quality and public health.

- Present a seminar on treatment plant operating procedures. This could be done at a central location so that Regia personnel from a number of cities could attend.

E. Pressure Reduction

Traditional supply side water savings and efficiency programs assess and reduce where appropriate system pressures in order to reduce pipeline stress and leakage and also to reduce customer usage. At lower pressures less water exits any given faucet, water fixture or orifice.

Such a program is premature and inappropriate for the City of Craiova given that some sections of the City depressurize and are without water on a daily basis. Initial efforts should be focused on maintaining system pressures and developing a computer model to assess the distribution system.

During a previous trip, Paul Hendricks instructed Regia personnel in the use of EPANET, a public domain software program developed by the US EPA. This program defines water system piping netwrok layouts and can perform all of the detailed network piping analysis that is required to solve complex engineering design and hydraulics problems.

Improving and maintaining minimum operating pressures is a high priority for Craiova not reducing pressure for water saving. Improving major transmission line capacity within the distribution system should be analyzed. Pressure zone management should be used to reduce the amount of pumping required in the higher elevations of the City.

Pressure reduction is impractical at this time and may adversely affect fire-fighting capabilities and available pressure at upper units of apartments. Representatives of apartment associations complained about inadequate pressure, especially at the top floor of a block of flats. At this time

physical suppression of system pressure is not recommended until the distribution network is fully analyzed.

A long term recommendation once twnety-four (24) hour a day water is achieved and the distribution network is modeled is as follows:

- Determine the range of pressures that exist in the distribution system.

- Develop a program to assess, implement and maintain reasonable operating pressures and reduce excess pressures where appropriate by creating high and low service areas through the installation of pressure reducing valves. Consideration should be given to pressure reduction if pressures within the system are excessive.

F. Removing Air in Pipeline and Improving Pressure Maintenance in the Distribution System

Many users I spoke with indicated a habit of leaving their faucets open in order to release system air. System air is air trapped in the distribution system pipelines. This customer practice reduced the wait for water once the system was again pressurized and water was available. This practice was reported to be a significant waste of water that was lost down the drain if the apartment dweller was not immediately there to shut-off the faucet once water began to run again. This is a problem related to the need to release air from the distribution system.

Failure to properly remove air from a pipeline can lead to line breaks and broken valves and pumps. Pockets of air that naturally accumulate at system high points can result in line restrictions. Like any restriction, a pocket(s) of air increases head loss, extends pumping cycles, and increases energy consumption. Proper release of air accumulated in the system will lead to the eventual abdication of the wasteful practice of leaving faucets open, it will also reduce pipeline surges and water hammer incidents, decrease pipeline break potential and reduce energy costs.

ACHIEVEMENT

On this trip information on air release valves was translated. The text was an AWWA fact sheet on air release valve basics. It includes a discussion of the causes of air in a system and describes various air release valves and types of installations. This information can be provided for distribution to Romanian cities with similiar air problems. See handwritten translation attached in Appendix C. The English version is attached as Appendix D.

RECOMMENDATIONS:

- Put on computer disk and print AWWA fact sheet on air release valves basics for discussion and distribution to Regia staff. Go over air release valve basics with personnel in Craiova.

- Subsequent technical advisors should assist Regia staff (Craiova) in determining effective air release valve locations and estimating numbers and costs. (TIMEFRAME: over next year).

- Print and distribute material on air release valves to other cities, Regia, and Judet officials in Romania.

G. Survey and Evaluation of Major Transmission Pipelines- *priority*

OBSERVATIONS:

On Friday June 30, 1994, the technical advisors inspected the facilities at Isvarna. This is a natural spring source of exceptional quality. The design capacity of the springs (natural artesian) is reported to be 1100 l/s. The effective pipeline capacity is estimated by Regia personnel to be 900 l/s. Mr. Nicolaescu, the Director of the Water Regia, estimates that only 50 l/s is lost or being used by others along the entire pipeline length. I observed a half dozen or so small villages along the pipeline route from Isvarna to Craiova City. I observed many open valves or spigots at the villages. These were often stuck or left running. My observations suggest that the Director's estimates are very low and may grossly underestimate water losses along the pipeline.

Very large greenhouses are situated on the outskirts of Craoiva, just beyond the City's boundaries. It was reported that these greenhouses have their own groundwater wells and merely use the Isvarna pipeline water for potable purposes only. Contradictory information was given as to whether the greenhouses are metered.

The pipeline is 100mm in diameter of welted steel pipe. The integrity of the pipeline is such that the Regia personnel are fearful of increasing its pressure or capacity. Corrosiveness or aggressiveness (chemically) of the water has not been determined. The general vegetation in the villages supported beautiful roses and tomato crops, both of which prefer slightly acidic soil conditions. Their presence indicates theadvisability of corrosion testing and monitoring.

To ensure the structural integrity of the pipeline and ascertain whether corrosion control chemical treatments are necessary, a program of corrosion testing and monitoring should be instituted. The benefits of corrosion monitoring and control include: reduced breakage and leakage, longer pipeline life, cost savings related to avoidance or delay of pipeline replacement costs, and increased supply assurance from decreased risk of loss of supply due to a major break.

ISSUES:

Director of the Regia de Apa, Mr. Nicolaescu, and the City Counsel Attorney discussed with me the issue of the uncertainity of ownership of the pipeline lands. The pipeline is located apparently outside of the roadway ROW and ownership of the lands overlying the pipeline is undefined. Post revolution land reform seems to have raised the issue of whether the Regia owns the pipeline or would need to compensate land owners. This seems to be a concern that

they were hestitant to address.

Some villages are entitled to Isvarna water via older agreements, but the limitations of those agreements are unclear and would need to be researched. It is likely that a significant amount of water is being stolen or lost along this pipeline.

Developing on-site alternative water sources for these villages will lessen the reliance on the pipeline water and increase the amount of this high quality water to the customers of Caraiova. Maximizing the amount of Isvarna water that arrives in Craiova should be a priority. This is the concept of utilizing the highest quality and lowest cost water first (maximizing existing resource use) before developing new water sources or substituting lower quality sources such as the Jiu River. It is less expensive to develop small communal wells for these villages, thereby increasing the water supply entering Craiova, rather than treating more Jiu River water.

If developing alternative supplies (wells) for these villages is not feasible, then consideration should be given to providing additional local storage to these local users on an off peak basis at a reduced rate.

The Giroc pipeline was reported by the Director of the Water Regia to be located totally within the roadway, and therefore, overlying land rights was not an issue. Nonetheless, the issues of corrosion control monitoring, leakage survey, and audit of users is identical to the problems associated with the Isvarna pipeline. The survey and solutions may be easier for this major transmission line given its closer distance to Craiova and lack of land rights issues. The physical leak survey may however be hampered by roadway traffic and noise. This pipeline may be a prime candidate to provide training as part of the recommended leak detection seminar.

We did not return via the roadway overlying the Giroc transmission pipeline. Therefore, I cannot comment on the existence or absence of villages pilfering water. Due to the shorter length of the Giroc pipeline, the magnitude of this problem is expectedly less but it is still advisedly prudent to perform a pipeline audit and survey.

RECOMMENDATIONS:

- The Regia should perform a survey or audit of the entire pipeline route to identify all users of water from the Isvarna and Giroc pipelines. Technical assistance for this task is strongly recommended.

  Estimate: Three separate trips are recommended: first,for reconnaissance of pipelines and establishing audit procedures and equipment needs; the second for physical audit: and the third for presentation of audits results. After the physical audit, the flow data must be analyzed and leakage and loss data computed. Equipment needs include: rental of a pipeline locator/metal detector, and transducers.

- Via the pipeline survey, document the quantity of water entering the pipeline at Isvarna and

Giroc, and then estimate the quantity being used by villages and other entities prior to reaching Craiova. Estimate number of wells and cost of developing alternative on-site water sources.

- The City Counsel in cooperation with the Regia should research the contracts with the villages along the Isvarna pipeline to confirm which ones are legally entitled to water and whether alternative sources, such as a village well, could be substituted.

- It is suggested that the Regia pay for the installation of community wells for the use of these villages where legally possible, or provide local storage.

- A separate detailed water audit of the greenhouses should be performed. Technical assistance could be requested to assist in performing this audit. Recommend that strap-on transducers be rented and utilized to determine the actual greenhouse water usage, by placing one before the greenhouses and another after. Use of these tranducers at various intervals along the pipeline will also help determine the leakage rate as well as the use rate of major users such as the greenhouse. Assistance in this area is strongly recommended.

- The Regia should institute a program using corrosion wafers (inserted through corporation taps) to monitor and determine aggressiveness of water.
  Estimate: approximately $100 per test per tap.

- It is also suggested that the Regia also perform general soil pH testing to evaluate the need for pipeline protection from external soil corrosion.

DEMAND MANAGEMENT

There are basically five major categories of demand management practices: Public Education; Pricing; Plumbing Code Revisons, Water Recycling and Reuse; and Water Use Regulations. Demand management is conservation measures which achieve permanent long-term water savings by providing incentives and technical assistance for consumers to reduce water use. Water use reductions associated with demand management will result in increased supply availability.

There are a number of advantages to demand management practices. These measures can be used to address both peak and average demand problems and both short and long term goals. A number of these practices are not labor intensive and most are inexpensive. In addition, many demand management practices can be implemented quickly.

There are also some disadvantages. The success of most of these measures is highly dependent upon user cooperation, thus response is difficult to predict. Revenue maintenance must be carefully managed through the rate making process. User opposition may also be experienced, especially regarding water use regulation. An effective public education/public relations program can often mitigate this initial opposition.

An on-going progam of public education is the foundation of any water saving program. Public information programs include: in-school education, public relations, media relations, employee communications, and customer outreach. Public education is the necessary first step of any water saving program. See previous detailed discussion on initial public education/water saving education steps initiated in Craiova.

A. Reduce Non-Recoverable Billings/Improve Billing Procedures

At the meeting with Regia staff, ICMA technical advisors reviewed current billing procedures. Industry is billed monthly and pays by bank check or at a special payment office (single location within City). There are approximately 14,00 private consumer accounts (number of bills). The Director estimated the percent of unpaid bills at 4-5%, although this was only an estimate.

Private residential consumers are billed quarterly. Bills are hand delivered. It costs approximately 200 Leu (12 cents US) to send a letter locally. Since average Regia labor cost is approximately one US dollar a day (2000 Leu), it is cheaper to send staff to hand deliver bills to flats and apartment buildings and simultaneously collect payment. This presents an opportunity to use these Regia personnel who come in direct contact with customers to hand out water saving information and answer questions on Regia activities.

There are approximately 14,000 private consumer accounts (number of bills). The Director estimated the percent of unpaid bills at 4-5%, although this was only an estimate. The major problem is with industry who are major user not being obligated to pay their bills for municipal services. Most industry and some commerical activities such as bakeries are considered essential or indispensable services, and the Regia is prohibited from cutting off services for non-payment of bills. Therefore, the industries don't pay.

I noted that in American even hospitals must pay their water and sewer bills. While a US water company may not cut off service to a hospital they could file a lein or law suit to recover costs through the court system. Industry may be indispensable from an economic perspective, they are not essential to health and welfare. Similair problem exists with homeownwer associations, which consist of a block of flats. The mechanisms for obtaining payment from a single nonpaying apartment owner don't exist, since the building is billed as a lum sum group not as individual apartments. Further discussion on master metering techniques and possible city ordinances which could increase payment and Regia revenue should be developed and discussed during a follow-up trip.

RECOMMENDATIONS:

- There is a need to investigate current regulations and develop recommended rules or ordinances to enforce and support implementation of a revenue capture program. It is recommended that a technical advisor discuss these with the Regia staff during a follow-up visit.

B. Water Rates/ Pricing

Pricing has been traditionally used as a water saving practice. There are a few important caveats which should be kept in mind regarding pricing and its potential for reducing consumer demand.

Price increases become more effective in reducing water use when water bills account for a significant portion of a family's budget. Given current incomes and the potential for dramatic rate increases pursuant to the EBRD loan conditions, it is estimated that water use could be reduced by 20-30%. Pricing is most effective in reducing industrial water use, particularly when inclining block rates are used to increase the price of water for large water consumers. Pricing as a water saving measure is a very complex issue which is utility and community specific. Establishment of a citizens advisory group is recommended.

With the institution of a customer metering program, consideration should be given to flat versus fixed rate versus life line rates. Establishing a life line rate that is too high will result in disincentives to water savings and achieving demand side efficiencies. Apartment associations expressed their preference for setting fixed or life line rates based upon current average per unit water use with a surcharge for excess use above this rate. The problem with this is that current usage amounts are excessive and include unaccounted-for and lost water. Therefore, such a rate structure would suppport wasteful water use practices.

Historically in Romania, the operating budget of the Regia had been subsidized by the federal government, resulting in an underpricing of the commodity. Some rate shock may be experienced as the Regia moves towards a rate structure that is reflective of operating costs and the true cost of water.

RECOMMENDATIONS:

It is recommended that a rate specialist be sent to Craoiva to discuss with Regia staff as well as with homeowners groups and representatives of apartment associations, the relative advantages and disadvantages of various rate structures and the relationship to water savings and revenue enhancement. Currently the surcharge for industry is three times that for residential users. Most residential users pay a flat (fixed rate) that is unrelated to usage. Rich Albani is recommended as a technical advisor. Formerly the director of the water unit at the Connecticut Departmnent of Public Utility Control, and Rate Specalist for General Water Works (a major national private investor owned utility), Mr. Albani is now a consultant with Wade Miller Associates.

The goal of the recommended technical advisor would be to investigate and determine currrent usage by user class (e.g. residential-homeowners, residential apartments/flats, commerical, industrial, and public authority use, city parks and Regia operations.) The advisor would also meet with Regia and citizen advisory groups to: discuss rate options, determine appropriate rate structures, and make recommendations to the City Council. The recommended rate structure would be predicated upon metering.

C. Industrial and Commercial Audits/ Recycling and Reuse

Water recycling and reuse are savings practices which are becoming very prevalent, especially in the industrial sector. As water rates rise, and sewer user charges are implemented, economics make it cheaper to recycle or reuse water than to purchase water from the Regia. (See discussion on water rates and pricing). A thorough water audit of a manufacturing plant is the best means of determining where water is being wasted and identifying possible recyling and reuse options. Very little discussion was had with contacts on this trip concerning large users and audits. It is suggested that the activities listed below be performed on a follow-up trip:

RECOMMENDATIONS:

- Investigate current Regia record keeping regarding industrial and other large water users. Examine meter and billing records, payment histories, and consider existence of alternative supply sources, and adequacy of meters.

- Provide general information to Regia staff on proper sizing of meters and impact on recording accuracy.

- Discuss with Regia staff the possibility that industrial users might be able to use raw or partially treated water, thereby enabling the increased capacity to be used to deliver additional potable water for higher quality uses (drinking).

- Determine extent to which facility audits would be beneficial, estimate number of possible audits and their cost. Establish criteria for determining audit priorities.

- Discuss benefits of offering leak detection services to large users once Regia staff has been trained and leak detection program of system is underway.

- Provide Regia staff with general water audit guidebooks (preferrably translated.)

At the current time there is little economic incentive for industries to cooperate with water audits and to investigate alternative sources or recycling and reuse options. As economic reforms take place, and non-recoverable billings are reduced, industry may be more receptive to audits. See recommendations regarding billing and grandfathering of essential users.

D. PLUMBING RETROFITS

1. REDUCTION OF RESIDENTIAL WATER USE

Inside the home, most water is used in the bathroom. In Romania ultra-low flow toilets are not readily available on the market. In the hotels that the technical team stayed in, the toilets were high volume 5 gallon or more per flush models. Toilets at other visited facilities

were both tank type and flushometer type, 3.5 to 5 or more gallons per flush, and wall mounted elevated tanks which are generally in the 2 gallon per flush range.

Typical Romanian faucets did not have threaded ends that aerators could be screwed in to. Where male or female threaded faucets exist, the quality of metal finish is such that stripping of the threads is possible. Showers are generally hand-held spray devices. Retrofitting these would require replacement of the entire fixture. Given the quality of plumbing fixtures and lack of market availability of fixtures, a physical retrofit of most water using fixtures is not cost effective or practical at this time.

Until distribution and supply improvements are enacted, it is premature to initate discussions with plumbing manufacturers/ industry representatives to investigate market conditions and means of promoting production or importation of low flow and ultra-low flow devices. Most devices require sufficient pressure of 40 to 60 psi minimum in order to function properly. Therefore, water system improvements are necessary in order for new devices to gain consumer acceptance.

The only two retrofit activities recommended at this time are insertion of displacement devices in the toilet tank and fixing leaks. Other behavioral changes to save water are discussed in the public education section. Toilets are the major users of water in a household, using up to 40% of all water. Studies performed by US Department of Housing and Urban Development estimate that fully one quarter of all toilets leak. Fixing leaky toilets can significantly reduce residential water usage. However, leak detection tablets are not readily available. Even food coloring is not a common household item.

Retrofit kits consisting of a simple home water audit guide, displacement/flow measuring bag, water savings tips and information on how to fix leaks are recommended for distribution to consumers. The informational components of a retrofit kit could be developed as part of the public education/water savings program. This should include information on how to fix a leaky toilet and the amount of water to be saved by placing a liter bottle in the toilet tank. Post card type information cards with a package of leak detection tablets attached could be developed if a supply of leak detection tablets could be provided by the technical team (ICMA).

This would be effective if distributed and instituted concurrent with the customer metering program. Bills typically rise as people adjust to paying for actual water usage and rates are modified to recover actual operating costs. Therefore, as rates rise and metering is implemented, consumers are likely to embrace water saving promotion in order to mitigate the impact of rising rates.

RECOMMENDATIONS:

- On a follow-up trip, work with the Regia staff to develop additional public information materials for apartment and homeowners. Focus should be on promoting practice of

placing a liter bottle filled partially with rock in the toilet tank in order to save water when flushing.

- Work with Regia staff to develop a proposed pilot program of toilet leak detection, and repair via a home water audit program. Such a program consists of providing information materials to homeowners so that they can perform the audit themselves. During such a follow-up trip, work with citizen's advisory group and Regia staff to develop instructions in Romanian and select test area or group.

- Provide a gross of leak detection tablets for use by Regia in pilot program.

  Estimate: Resource Conservation -Greenwich CT. Leak detection tablets 4 to 8 cents in bulk, 5,000 packages to a gross box. *Budget: $600*. If pre-stapled on a Romanian instruction card cost is 15 to 23 cents a package. Romanian translation and preprinted post card for the leak tablets could be generated cheaper during a follow-up visit by using ICMA technical advisors and local printing.

2. RETROFIT OF PUBLIC FACILITIES

Pilot Projects Park/Schools

In Romania, low-flow spray nozzles, and ultra-low flush toilets are not yet available in the marketplace. As these fixtures become available, a pilot program of installing these devices in public building during change-out or replacement is recommended.

Hose bibs and adjustable spray nozzles for regulating outside watering are strongly recommended. To showcase these devices, it is recommended that a number of flexible hoses, couplings and adjustable spray nozzles and sprinklers be purchased by the Regia Autonom Domeniul Public and utilized in Romanescu Park.

E. PLUMBING CODE REGULATIONS

Plumbing or building code regulations that require installation of water saving devices in all new construction are very popular in the United States and many Western European countries. In the US, these requirements were initially adopted by a number of states and municipalities. Subsequently, the Energy Policy Act established nationwide plumbing efficiency standards. In Romania, plumbing code regulations could be adopted on either the Jutte or local level.

Requiring the installation of water saving fixtures in all new construction through the adoption of building code revisions is probably the least expensive water saving measure a local jurisdiction can undertake. However, the market place must have ready access to low-flow devices in order for this technique to be successfully implemented. In Romania, low-flow spray nozzles, and ultra-low flush toilets are not yet available in the marketplace.

CONCLUSIONS:

ICMA technical advisors toured the major water supply facilities including sources and treatment stations. Recommendations for increased operational efficiency and suggestions for supply side water savings were developed. Recommended actions that are considered likely to have the greatest impact on supply availability and decrease of lost and unaccounted-for water are :

LEAK DETECTION
CUSTOMER METERING
MODIFICATION OF RATE STRUCTURE
INDUSTRIAL USE SUBSTITUTION

SUMMARY OF FURTHER TECHNICAL INPUT ITEMS:

Recommended activites requiring input from ICMA technical advisors has been detailed in this report. Tasks which should be *immediately* addressed include:

- Present a teachers workshop on water saving education
- Follow-up activities to support and continue water saving programs initated during July 1994 trip, including:
  - Translate and present information to Regia staff and City Hall personnel on "how to write a press release"
  - Work with Regia staff to develop water saving leaflets in Romanian for their use
  - Provide Regia with leak detection tablet for a pilot program on home toilet leak detection.
- Provide technical assistance to calculate stage/flow curves, install flow measuring devices, and establish recording and data collection methods at all water source, wells, pump stations and treatment plants.
- Translate and provide a basic manual for operation and maintenance of the treatment plants and pump stations. Develop a training course.
- Provide technical advisors to initiate audit and survey of Isvarna and Giroc pipelines.
- Audit the water and energy use of the large Greenhouses -substitute alternative non-potable water to reduce demands on pipelines.
- Provide technical assistance to design a comprehensive leak detection program
- Present a techncial seminar and training on the use of sonic leak detection methods

OVERVIEW

This report evaluates and presents various water saving and efficiency improvements for the City of Craiova. Currently, water is not available to all parts of the City on a 24 hour basis. Some areas have water only 10 hours a day - 5 in the morning, 5 in early evening. It is the goal of the City Council to improve the infrastructure and make water available continously.

Many of the water saving options presented in this report require technical input and assistance in order to implement them successfully. Water savings/efficiency measures are cost effective and can dramatically increase the availability of water. The major focus of this trip/report was to initate a water education program for the City of Craiova. Public education programs constitute a desirable, and necessary component of all demand and supply oriented water saving programs. Public education is the cornerstone of long-term water saving and efficiency improvement programs. Supply side improvement by the water utility (Regia) in Craiova should focus on accounting of water use (metering), leak detection and repair programs,and industrial/commercial audits and supply substitution. Demand side water saving programs should include a continuing public education component.

It has been a pleasure to work on a project that can result in immediate improvements in the quality of life for a reemerging country. The wise use of water will result in increased supply availability and improved standard of living for the citizens of Craiova. ***Folositi apa cu masura!***

SAMPLE WATER SAVING TIPS

Turn off water while brushing teeth and save 12,000 liters or more of water a year.
Water, use it wisely!

****

Turn off water while shaving and save 15,000 liters of water a year. *Water use it wisely!*

****

Don't use the toilet for a wastebasket. Each flush uses about 15 liters of water.
Water, use it wisely!

****

Fix that leak! A small drip can waste 60 liters a day. (That's over 20,000 liters a year).
Water use it wisely!

****

Place a plastic bottle, filled with water and weighed down by rocks, in your toilet tank.
Save one liter to 1.5 liters a flush. *Water, use it wisely!*

****

Toilet flushing uses 10 to 15 liters each flush. Flush only when necessary.
Water, use it wisely!

****

Use the stopper in your sink, and let the bowl fill for rinsing. *Water, use it wisely!*

****

Thaw foods ahead of time or in ponded water, instead of quick thawing them under
hot running water. *Water,use it wisely!*

****

Wash fruits and vegetables in ponded water, then use the water for plants and/or garden.
Water, use it wisely!

****

Remove ice cube trays a few minutes before you plan to use them to avoid running them under water to loosen them. *Water, use it wisely!*

****

Fill the bath tub one quarter full for bathing and save 85 liters of water. *Water, use it wisely!*

****

Turn off the water when soaping up in the shower. *Water use it wisely!*

****

Wash the car from a bucket, saving the hose only for the final rinse. *Water, use it wisely!*

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